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**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

**TITLE OF THE INVENTION**

Wireless telecommunication system

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## WIRELESS TELECOMMUNICATION SYSTEM

### FIELD OF THE INVENTION

The present invention relates to the field of telecommunications and particularly to  
5 the area of wireless telecommunication systems.

### BACKGROUND OF THE INVENTION

In a typical cellular radio system, mobile user equipment (UE) communicates via a  
radio access radio network (RAN) to one or more core networks. User equipment  
10 (UEs) comprises various types of equipment such as mobile telephones (also  
known as cellular or cell phones), lap tops with wireless communication  
capability, personal digital assistants (PDAs) etc. These may be portable, hand  
held, pocket sized, installed in a vehicle etc and communicate voice and/or data  
signals with the radio access network.

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The radio access network covers a geographical area divided into a plurality of  
cell areas. Each cell area is served by at least one base station, which may be  
referred to as a Node B. Each cell is identified by a unique identifier which is  
broadcast in the cell. The base stations communicate at radio frequencies over an  
air interface with the UEs within range of the base station. Several base stations  
20 may be connected to a radio network controller (RNC) which controls various  
activities of the base stations. The radio network controllers are typically  
connected to a core network.

25 An example of a radio access network is the Universal Mobile  
Telecommunications System (UMTS) Terrestrial Radio Access Network  
(UTRAN). UMTS is a third generation mobile communication system and

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essentially relates to a wide band code division multiple access (W-CDMA) system.

W-CDMA technology allows simultaneous communication between user equipment and a plurality of base stations using a common frequency band. Signals occupying a common frequency band are discriminated in the receiving base station through spread spectrum CDMA waveform properties based on the use of a high speed, pseudo-noise (PN) code. These high speed PN codes are used to modulate signals transmitted from the base stations and the user equipment. A transmitting station uses a PN code to produce signals that can be separately demodulated at a receiving station. In CDMA therefore a user equipment unit need not switch frequency when handover of the connection is made from one cell to another. Thus, a destination cell can support a connection to the user equipment at the same time as the original cell continues to provide service. Since the UE is always communicating through at least one cell during hand over, there is no disruption to the call.

There are several interfaces defined in the UTRAN. In some instances a connection involves both a serving or source RNC (SRNC) and a target or drift RNC (DRNC), with the SRNC controlling the connection but with one or more diversity legs of the connection being handled by the DRNC. UMTS has both common transport channels and dedicated transport channels. Common transport channels include the random access channels (RACH), the forward access channel (FACH), the common packet channel (CPCH) and the downlink shared channel (DSCH). Dedicated transport channels include the dedicated channel (DCH). These transport channels are described for example in one or more of the following specifications:

ETSI TS 125.211 Version 3.12.0 "Physical Channels and Mapping of Transport Channels on to Physical Channel (FDD);

ETSI TS 125.221 Version 3.11.0 "Physical Channels and Mapping of Transport Channels on to Physical Channel (TDD);

- 5 ETSI TS 125.331 Version 3.15.0 "Radio Resource Control (RRC) Protocol Specification.

When switching from a dedicated to a common channel in UMTS, the UE is assigned a temporary identifier known as C-RNTI (Cell Radio Network 10. Temporary Identifier). This temporary identifier C-RNTI is specific to a cell and is valid in the cell where the UE uses resources. The C-RNTI is used to distinguish between different user equipment in that cell.

When switching from dedicated channels to common channels, the network can 15 assign the radio resources to be used only if the UE is in a cell under control of the serving SNC (SRNC). In other words, if the UE is in a cell under the control of a drift RNC (DRNC) rather than SRNC, it is not possible for the network to assign the radio resources to be used when switching from dedicated channels to common channels. This results in longer signalling sequences between the UE and the 20 network as well as additional delay when switching from dedicated channels to common channels. The UE itself must obtain the temporary identifier C-RNTI by additionally signalling between the UE and UTRAN before continuing to communicate with the network. Furthermore, the lack of information regarding which range of resources to use means that the UE needs to detect and read 25 information about the range of resources and the broadcast channel in the cell before accessing the cell. This again incurs additional delay when switching from dedicated channels to common channels.

## BRIEF DESCRIPTION OF DRAWINGS

The present invention is illustrated by way of example, and not by way of limitation, in the figures of the accompanying drawings and in which like reference numerals refer to similar elements and in which:

Fig. 1 shows a schematic diagram of a radio access network system;

Fig. 2 shows the components of a user equipment used with the radio access network system of figure 1;

10 Fig.3 illustrates the cell update procedure used with a radio access network system as shown in Fig.1;

Fig. 4 is a flow chart illustrating the operation of a first embodiment of a system;

Fig. 5 is a flow chart illustrating the operation of a second embodiment of a system; Fig. 6 is a flow chart illustrating the operation of a third embodiment of the  
15 system; and

Fig. 7 is a flow chart illustrating the operation of a fourth embodiment of the system.

A method and apparatus for processing a message received by a device from a  
20 network is described. In the following description, for the purposes of explanation, numerous specific details are set forth in order to provide a thorough understanding of the present invention. It will be apparent, however, to one skilled in the art that the present invention may be practised without these specific details. In other instances, well-known structures and devices are shown in block  
25 diagram form in order to avoid unnecessarily obscuring the present invention.

The needs identified in the foregoing Background, and other needs and objects that will become apparent from the following description, are achieved by, in one

aspect, a method for processing messages received by a device from a network. The method comprises receiving a message that indicates that the device should move into a dedicated channel state (such as Cell\_DCH), wherein the message is a message other than a reconfiguration message. On receipt of such a message (e.g a  
5 Cell Update Confirm message or a RRC Connection Setup message) and before moving to the dedicated channel state, the device clears any record of a cell identifier.

The following are reconfiguration messages: Radio Bearer Setup message, Radio  
10 Bearer Reconfiguration message, Radio Bearer Release message, Transport Channel Reconfiguration message or Physical Channel Reconfiguration message.

In other aspects, the invention encompasses apparatus and a computer-readable medium configured to carry out the foregoing steps. In particular, the method may  
15 be implemented in a mobile telecommunications device, with or without voice capabilities, or other electronic devices such as handheld or portable devices.

Figure 1 shows an overview of the radio access network (UTRAN) used in a UMTS system. The network as shown in Figure 1 comprises three Radio Network Subsystems (RNS)  
20 2. Each RNS has a Radio Network Controller (RNC) 4. Each RNS 2 has one or more Node B 6 which are similar in function to a Base Transmitter Station of a GSM radio access network. User Equipment UE 8 may be mobile within the radio access network. Radio connections (indicated by the straight dotted lines in Figure 1) are established between the UE and one or more  
25 of the Node Bs in the UTRAN.

The radio network controller controls the use and reliability of the radio resources within the RNS. Each RNC is also connected to a 3G mobile switching centre 10 (3G MSC) and a 3G serving GPRS support node 12 (3G SGSN).

- 5 An RNC controls one or more Node B's. An RNC plus its Node B's together make up an RNS. A Node B controls one or more cells. Each cell is uniquely identified by a frequency and a primary scrambling code (primary CPICH in FDD, primary CCPCH in TDD).
- 10 Generally in UMTS a cell refers to a radio network object that can be uniquely identified by a UE from a cell identifier that is broadcast over geographical areas from a UTRAN access point. A UTRAN access point is a conceptual point within the UTRAN performing radio transmission and reception. A UTRAN access point is associated with one specific cell i.e., there exists one UTRAN access point for each cell. It is the UTRAN-side end point of a radio link.
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C-RNTI, the Cell Radio Network Temporary Identity, is a UE identifier allocated by the controlling RNC and it is unique within one cell controlled by the allocating CRNC. C-RNTI can be reallocated when a UE accesses a new cell with a cell update procedure. C-RNTI is used as a UE identifier in DCCH/DTCH common channel messages on the radio interface.

Figure 2 shows a schematic diagram of various components of UMTS user equipment. The UE 8 includes an antenna 80 and a transceiver 82 for transmitting and receiving radio signals. In the Time Division Duplex (TDD) mode of UMTS, the transceiver 82 may use a rake receiver to establish the signal to be operated on by the UE. The transceiver 82 is connected to a processor 84 which processes the

signals received by and sent by the transceiver. The processor 84 has connections to memory 86 and a user interface device 88 (such as a keyboard and/or a screen). Figure 2 only shows the main components of the UE. Clearly the UE will include other components which are not shown but which are not relevant for the present understanding.

Figure 3 shows the cell update procedure in UMTS. Firstly the UE sends a cell update to the UTRAN. ETSI TS 125.331 Version 03.15.00 Section 8.3.1.5 describes what occurs at the UTRAN when the UTRAN receives a cell update message from a UE. Among other things, the UTRAN transmits a cell update confirm (CUC) message. ETSI TS 125.331 Version 03.15.00 Section 8.3.1.6 describes the operation of the UE on reception of a cell update confirm message from the UTRAN. The UE may, in response, send a Physical or Transport Channel Configuration Complete message or any other suitable message or possibly no response message.

In UMTS, cell radio network temporary identifiers (C\_RNTIs) are allocated by each cell in the UTRAN to each user equipment (UE) that is in the cell and is in Cell\_FACH. When the UE leaves Cell\_FACH or leaves the cell, the C-RNTI is no longer required by the UE.

Figure 4 illustrates the operation of a first embodiment of the proposed method in which the C-RNTI is cleared when entering Cell\_DCH on receipt of a message other than a reconfiguration message. When a UE receives a cell update confirm message (step 401) the UE determines (step 402) whether the CUC message indicates that the UE should move to the state Cell\_DCH. If the cell update confirm message indicates that the UE should move from Cell\_FACH to

Cell\_DCH, the UE clears the C\_RNTI variable (step 403) existing in the UE. The device then continues (step 404) with other processes. If the CUC message does not indicate that the UE should move from Cell\_FACH to Cell\_DCH then the UE continues (step 404) with other processes.

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A similar process may be carried out on receipt of a URA Update Confirm Message.

10 ETSI Standard TS 125.331 version 3.15.0 (and other similar CDMA standards) may be amended to implement these proposals.

For instance section 8.1.3.6 of the above standard may be amended as follows.

On reception of a cell update confirmation/URA update confirm message by the UE:

15 If the UE after state transition enters CELL\_DCH state, it shall:

1> in FDD; or

1> in TDD when "Primary CCPCH Info" is included indicating a new target cell and "New C-RNTI" is not specified:

2> remove any C-RNTI from MAC;

2> clear the variable C\_RNTI.

20 Figure 5 illustrates a second embodiment of the proposed method in which the C-RNTI is cleared when entering Cell\_DCH. This time the non-reconfiguration message being considered is a RRC Connection Setup message. When a UE receives a RRC Connection Setup message from the network (step 501), the UE determines (step 502) whether the RRC Connection Setup message indicates that the UE should move to the state Cell\_DCH. If the RRC Connection Setup

message indicates that the UE should move to Cell\_DCH the UE clears the C\_RNTI variable (step 503) existing in the UE. The device then continues (step 504) with other processes. If the RRC Connection Setup message does not indicate that the UE should move to Cell\_DCH then the UE continues (step 304) with other processes.

ETSI Standard TS 125.331 version 3.15.0 (and other similar CDMA standards) may be amended to implement these proposals.

10 For instance, section 8.1.3.6 of this standard, and in particular the part which relates to the reception of a “RRC connection setup message by the UE”, may be amended as follows:

15 1> if the UE, according to subclause 8.6.3.3, will be in the CELL\_DCH state at the conclusion of this procedure:

2> in FDD; or

2> in TDD when “Primary CCPCH Info” is included indicating a new target cell and “New C-RNTI” is not specified:

3> remove any C-RNTI from MAC;

20 3> clear the variable C\_RNTI.

Thus the UE removes the C-RNTI when entering CELL\_DCH so that the UE and the network do not end up with different C-RNTIs if the UE enters CELL\_FACH state and uses a stored C-RNTI. This prevents the UE from entering 25 CELL\_FACH with the CELL C-RNTI which may belong to a different UE and therefore prevents the UE capturing messages intended for another UE.

Figure 6 is a flow chart showing the operation of a further embodiment. This relates to the situation in which a message other than a reconfiguration message is received which both moves the UE to Cell\_DCH and also includes a cell identifier in the received message. In this embodiment an RRC connection setup message is received (step 601). The UE then checks whether the message instructs the UE to move to Cell\_DCH (step 602). If the RRC connection setup message includes such an indicator, the UE then checks whether the message includes a C\_RNTI (step 603). If so, the UE then takes avoiding action (step 604). Examples of such an avoiding action are that the UE rejects such a message as invalid; ignores such a message; moves to Cell\_DCH but ignores the C\_RNTI; moves to Cell\_FACH and ignores the Cell\_DCH state indicator; or takes another action to ensure that it is not in Cell\_DCH with a C\_RNTI stored. The device then continues (step 605) with other processes.

Thus this embodiment provides a method of processing messages received by a device from a network. The method comprises receiving a message that indicates that the device should move into a dedicated channel state, wherein the message is a message other than a reconfiguration message and includes a cell identifier. Before moving to the dedicated channel state, the device takes further action to deal with the cell identifier in the received message..

Figure 7 is a flow chart showing the operation of a further embodiment of the operation of a UE. Similarly to the embodiment illustrated by Figure 6, in Figure 7, it is shown that when a new C-RNTI is received which means that the UE will remain in or transition to Cell\_DCH, then some action is taken to avoid being in Cell\_DCH with a C-RNTI stored in the C\_RNTI variable. Thus on receipt of a new C-RNTI (step 701) the message in which the C-RNTI is included is examined

to see if the message tells the UE to remain in or transition to Cell\_DCH. If it does, the UE takes avoiding action (step 703). If it does not, then the UE may continue with other processes (step 704) which will not be discussed further. Examples of avoiding action are that the UE should reject such a message as invalid; should ignore such a message; should remain in (or transition to) Cell\_DCH but ignore the C\_RNTI; move to Cell\_FACH if required and perform Cell\_UPDATE; or should take some other action to ensure that it is not in Cell\_DCH with a C\_RNTI. The device then continues (step 704) with other processes.

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Such operations in particular are applicable to Section 8.6.3.9 of ETSI TS 125.331 Version 3.15.0.

Thus the UE is able to manage messages, other than reconfiguration messages, when entering Cell\_DCH.

It is to be noted that the methods as described have shown steps being carried out in a particular order. However, it would be clear to a person skilled in the art that the order of the evaluation is immaterial with respect to the operation of the method. For instance, the device may check in any order whether a C-RNTI is included in the message or whether the message moves the UE into Cell\_DCH. The ordering of the steps as described herein is not intended to be limiting.

In the foregoing specification, the invention has been described with reference to specific embodiments thereof. It will, however, be evident that various modifications and changes may be made thereto without departing from the broader spirit and scope of the invention. The specification and drawings are,

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accordingly, to be regarded in an illustrative rather than a restrictive sense. Any features as claimed may be used in combination or separately.